

What is Claimed is:

1 1. A full-color LED device, comprising:

2 a first semiconductor substrate;

3 a buffer layer covering said first semiconductor substrate;

4 first and second color LED elements formed above said buffer layer;

5 a first passivation layer covering said first and second color LED elements and said  
6 buffer layer;

7 a second semiconductor substrate formed above said first passivation layer;

8 a third color LED element fabricated above said second semiconductor substrate; and

9 a second passivation layer covering said first semiconductor substrate, said buffer  
10 layer, said first passivation layer, said second semiconductor substrate and said third  
11 color LED element.

12 2. The full-color LED device as claimed in claim 1, wherein said second semiconductor  
13 substrate does not overlap said first and second LED elements.

1 3. The full-color LED device as claimed in claim 1, wherein said second semiconductor  
2 substrate has a thickness less than 1  $\mu\text{m}$ .

1 4. The full-color LED device as claimed in claim 1, said first semiconductor substrate  
2 comprising GaAs, GaP or InP, and said first and second color LED elements being  
3 red and green LED elements.

1 5. The full-color LED device as claimed in claim 1, said first semiconductor substrate  
2 comprising sapphire or SiC, and said first and second color LED elements being blue  
3 and green LED elements.

1 6. A full-color LED display comprising a plurality of full-color LED devices as claimed  
2 in claim 1, said plurality of full-color LED devices being arranged in rows and  
3 columns.

1 7. A full-color LED device, comprising:

2 a first semiconductor substrate;

3 a buffer layer covering said first semiconductor substrate;

4 a first color LED element formed above said buffer layer;

5 a first passivation layer covering said first color LED element and said buffer layer;

6 a second semiconductor substrate formed above said first passivation layer;

7 second and third color LED elements fabricated above said second semiconductor  
8 substrate; and

9 a second passivation layer covering said first semiconductor substrate, said buffer  
10 layer, said first passivation layer, said second semiconductor substrate and said  
11 second and third color LED elements.

12 8. The full-color LED device as claimed in claim 7, wherein said second semiconductor  
13 substrate does not overlap said first color LED element.

1 9. The full-color LED device as claimed in claim 7, wherein said second semiconductor  
2 substrate has a thickness less than 1  $\mu\text{m}$ .

1 10. The full-color LED device as claimed in claim 7, said first semiconductor substrate  
2 comprising GaAs, GaP or InP, and said first color LED element being a red LED  
3 element.

1 11. The full-color LED device as claimed in claim 7, said first semiconductor substrate

2 comprising sapphire or SiC, and said first color LED element being a blue LED  
3 element.

1 12. A full-color LED display comprising a plurality of full-color LED devices as claimed  
2 in claim 7, said plurality of full-color LED devices being arranged in rows and  
3 columns.

1 13. A method of manufacturing a full-color LED device, comprising the steps of:  
2 preparing a first semiconductor substrate;  
3 forming a buffer layer above said first semiconductor substrate;  
4 fabricating a first color LED element on said buffer layer;  
5 fabricating a second color LED element on said buffer layer;  
6 covering said first and second color LED elements and said buffer layer with a first  
7 passivation layer;  
8 bonding a second semiconductor substrate onto said first passivation layer;  
9 polishing said second semiconductor substrate into a thin second substrate layer;  
10 forming a third color LED element on said thin second substrate layer; and  
11 covering said first semiconductor substrate, said buffer layer, said first passivation  
12 layer, said thin second substrate layer, and said third color LED element with a  
13 second passivation layer.

1 14. The method of manufacturing a full-color LED device as claimed in claim 13,  
2 wherein said thin second substrate layer does not overlap said first and second LED  
3 elements.

1 15. The method of manufacturing a full-color LED device as claimed in claim 13,  
2 wherein said thin second substrate layer has a thickness less than 1  $\mu\text{m}$ .

1 16. The method of manufacturing a full-color LED device as claimed in claim 13, said  
2 first semiconductor substrate comprising GaAs, GaP or InP, and said first and second  
3 color LED elements being red and green LED elements.

1 17. The method of manufacturing a full-color LED device as claimed in claim 13, said  
2 first semiconductor substrate comprising sapphire or SiC, and said first and second  
3 color LED elements being blue and green LED elements.

1 18. A method of manufacturing a full-color LED device, comprising the steps of:  
2 preparing a first semiconductor substrate;  
3 forming a buffer layer above said first semiconductor substrate;  
4 fabricating a first color LED element on said buffer layer;  
5 covering said first color LED element and said buffer layer with a first passivation  
6 layer;  
7 bonding a second semiconductor substrate onto said first passivation layer;  
8 polishing said second semiconductor substrate into a thin second substrate layer;  
9 fabricating a second color LED element on said thin second substrate layer;  
10 fabricating a third color LED element on said thin second substrate layer; and  
11 covering said first semiconductor substrate, said buffer layer, said first passivation  
12 layer, said thin second substrate layer, and said second and third color LED elements  
13 with a second passivation layer.

1 19. The method of manufacturing a full-color LED device as claimed in claim 18,  
2 wherein said thin second substrate layer does not overlap said first LED element.

1 20. The method of manufacturing a full-color LED device as claimed in claim 18,

2 wherein said thin second substrate layer has a thickness less than 1  $\mu\text{m}$ .

1 21. The method of manufacturing a full-color LED device as claimed in claim 18, said  
2 first semiconductor substrate comprising GaAs, GaP or InP, and said first color LED  
3 element being a red LED element.

1 22. The method of manufacturing a full-color LED device as claimed in claim 18, said  
2 first semiconductor substrate comprising sapphire or SiC, and said first color LED  
3 element being a blue LED element.

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